High Pressure Phase Behavior of Binary Gas Diamondoid Systems

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In the North Sea high pressure, high temperature gas condensate reservoirs with reservoir pressures up to 120 MPa are found. These gas condensate reservoir fluids contain relatively large amounts of heavy hydrocarbons, like alkanes, phenylalkanes, polycyclic aromatics and diamondoids. During production liquid drop out and solid precipitation can occur. Drop out of these condensed phases can plug pipelines or even the reservoir.

As a part of a long term project on the study of the phase behavior of asymmetric hydrocarbon systems of importance for the production of gas condensate reservoirs the phase behavior of the diamondoids adamantane and diamantane with light hydrocarbons such as methane, ethane, propane and butane and with carbon dioxide are studied. Solid-fluid and vapor-liquid equilibria were determined experimentally according to the synthetic method in the temperature range 323-473 K and at pressures up to 200 MPa. In this contribution experimental results for these systems will be discussed.

Basically two types of phase behavior are found. In systems of low-molecular weight (gases like methane with diamondoids), it is found that the three-phase curve solid diamondoid-liquid-vapor intersects the vapor-liquid critical curve twice. In systems with gases with a higher molecular weight like butane, the three-phase curve solid diamondoid-liquid-vapor does not intersect the vapor-liquid critical curve. An extra complication in the systems with diamantane is that solid diamantane shows a solid-solid transition in the temperature range of interest.